MONTHLY NOTICES

OF THE

ROYAL ASTRONOMICAL SOCIETY.

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WARREN DE LA RUE, Esq., President, in the Chair.

Charles Todd, Esq., Director of the Observatory at Adelaide;
Henry Syme Redpath, Esq., Sydenham; and
Frederick Hungerford Bowman, Esq., Halifax,

were balloted for and duly elected Fellows of the Society.

It was announced that a List of the Fellows, corrected up to the 31st December, 1863, will shortly be distributed. There is a difficulty in getting it absolutely correct; and the Fellows are requested to make known to the Assistant Secretary any corrections that are necessary.

State of Meteoric Science. By A. S. Herschel, Esq.

(Communicated by the Rev. C. Pritchard.)

It is a saying of Arago, founded originally upon observation and confirmed by constant experience in later years, that the Earth encounters more shooting-stars in going from aphelion to perihelion than in going from perihelion to aphelion.

In point of fact, between the north latitudes of 49°·5 and 54°·2, Dr. Julius Schmidt, the indefatigable Director of the Observatory at Athens, observed, during eight years, from 1843 to 1850, on an average 470 meteors in every year. His observations were distributed in the several months, according to the following average of the entire series:—

Anomalistic Year.	Month.	Shooting-Stars.	Total Shooting-Stars.
Aphelion to Perihelion	July	49	400
	August	188	
	September	41	
	October	37	
	November	54	
	December	31	
Perihelion to Aphelion	January	17	70
	February	5	
	March	11	
	April	11	
	May	12	
	June	14	
		Total	470

Supposing, with Arago, that shooting-stars are meteorites or particles describing planetary orbits in all directions round the Sun, no one of these meteorites can overtake the Earth, if the native velocity of all is less than the planetary motion of the Earth itself; on the contrary, the Earth will overtake, in a greater or less degree, the whole of those which it meets, if we suppose its velocity to be greater than that of every individual shooting-star. Even upon more general assumptions, however, of the orbital velocities of meteorites, it follows that a more or less powerfully determined current of falling-stars must arrive upon the Earth, owing to its planetary motion, from a constantly prevailing direction ninety degrees in longitude behind the Sun.

On this account a season of frequency of aerolites, shooting-stars, and bolides, must be expected to succeed, in all latitudes, three months later than the summer season of the Sun; but, on the other hand, a dearth of meteors, in the spring, one quarter of a year later than mid-winter. In general, and in all latitudes, the meteoric seasons, or seasons of meteoric frequency, must strictly follow the tropical seasons, and three months later in the year. Thus, in the Earth's northern hemisphere the northern pole remains directed to the Sun from the equinox of March until that of September, and to the course of meteors from the solstice of June to the solstice of December. The

greatest frequency of the meteorites will fall about the equinox of autumn, in September and October. This most nearly agrees with the European observations. The meteoric season of Arago may, therefore, be drawn as a consequence from his planetary hypothesis, if it be permitted to change the limits which he assigns to it by a small quantity, namely, from the Earth's apsides to its solstices in its orbit.

The same fact, which appears strongly marked with regard to shooting-stars in the eight-year summary of Dr. Schmidt, is found repeated in a striking manner in the existing Northern Catalogues of *Star-showers*, *Fire-balls*, and *Aeroliths*. The following references may be taken as examples:—

Appearances.	Number, July to December.	Number, January to June.
Star-showers, from 1800 B.C. In M. Quetelet's Catalogue (*Physique du Globe*, 1861)	72	28
Aerolitic Meteors, from the Christian Era. In Mr. Greg's Catalogue (*Brit. Ass. Report*, 1860)	216	186½
Large and small *Fire-balls*. In same Catalogue (*Ibid.*)	843	553

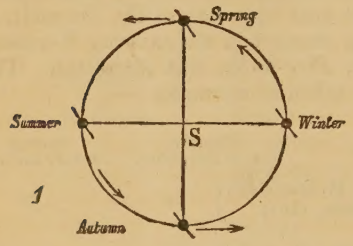
The time appears therefore at length to have arrived when observations of meteors in the southern hemisphere may greatly contribute to establish the *planetary* theory of meteorites. Should the same sequences of meteoric seasons, after the tropical seasons, be observed in the Southern hemisphere which are followed in the north, the record of meteors in Southern Observatories will become at once a confirmation of the planetary motion of the Earth, and a proof of the correctness of the existing theory of shooting-stars. A sufficient number of data can only be collected in the course of time; but the observations of shooting-stars at Melbourne, in South Australia, already preserved for some years, in great numbers, by Dr. Neumayer, appear actually calculated to give to this question, before long, a satisfactory solution.

March 1, 1864.

After the reading of the preceding paper, Mr. Pritchard, according to a previous arrangement, addressed to the Meeting certain remarks, of which the following is a summary:—

The great merit of Mr. Herschel's communication consists in this, that he has shown how certain principles which have already been applied to account for the increased number of

meteorolites visible in the later hours over those visible during the earlier hours of the night grasp and explain also why in northern latitudes more meteors appear at and about our autumn than at or about our spring, and in general more meteors from summer through autumn to winter, than from winter through spring to summer.



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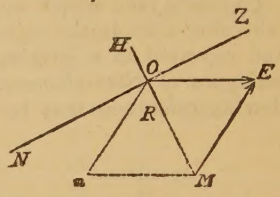

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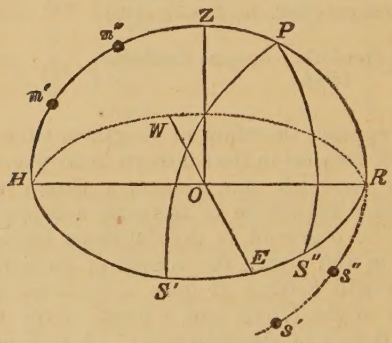

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In the seventeenth volume of the *Monthly Notices*, p. 148, there is a very short but valuable paper on this subject by Mr. Bompas, which, on account of its extremely condensed form, has probably met with far less attention than it deserves. The author of the paper thus inopportunely abridged shows how, by attributing to meteors an average velocity double that of the Earth in its orbit, nearly two-thirds of their number would have an apparent motion opposed to the motion of the Earth, with a gradual increase of frequency during the night from 6 A.M. to 6 P.M. This phenomenon Mr. Bompas finds completely in accordance with the extensive observations of M. Coulvier Gravier. Mr. Herschel has extended the application of the principle of Mr. Bompas to *annual seasons* of meteoric frequency; and in a communication yet to be made to the Society he will show how certain formulæ of calculation

which he has investigated appear to represent with considerable accuracy observations of a trustworthy character.

It may be of advantage to the Members for Mr. Pritchard to place this very interesting though but little-understood subject in the simple point of view in which it has occurred to himself. The hypothesis made regarding shooting-stars is that they move in orbits round the sun, exhibiting (so far as is yet known) no preference whatever either with regard to eccentricity, to inclination to the ecliptic, or to direct or retrograde motion. Neither is reference now made to any want of uniformity in their distribution in the intrastellar region. Our object is to show that this hypothetical uniformity of distribution, combined with the direction and amount of the Earth's motion, will have a very sensible effect on the number of meteors actually visible at a given place, at a given hour of the night, as explained (in a somewhat different way) by Mr. Bompas, and at a given season of the year, as extended by Mr. Herschel.

For the purposes of illustration, suppose H O R (fig. 2) to represent a flat umbrella, of which N O is the stick ; suppose, also, rain to fall upon it equally, and in all directions : then, if the umbrella be at rest, as much rain will fall on its front, looking from Z, as on its back, from N.

But now suppose the umbrella itself has a motion from O to E in a given time, and, for simplicity of first conception, let O E represent also the uniform velocity of the rain : very much more rain will now fall on the front of H O R, and much less on the back of H O R, than before. In fact, if O *m* be taken = O E, and the angle *m* O R be made = R O E, and the parallelogram *m* E be completed, then a raindrop, of which *m*'s real path is M E, would by the motion of H O R just graze along the front surface of H O R in the direction M R O, when it arrives at E. Moreover all the rain which at the beginning of the motion was moving within the angle *m* O R, and which would have fallen on the back of H O R at rest, will now fall on the front of H O R, if in motion.

The application of this hypothetical case to that of meteors is obvious. H O R now represents the horizon, Z the zenith of an observer, and O E the direction and magnitude of the Earth's orbital motion. The Earth's diurnal motion of rotation is comparatively too small to be taken into the account for our present purposes. So long, then, as O E, the direction of the earth's orbital motion, is in front of the horizon of an observer, there will thereby occur to him an additional flow (and partial combustion) of meteors against the Earth's atmosphere above him ; and this increased flow will become the greater, as the angle R O E becomes greater. If O E be below H O R, then the number of visible meteors will thereby be diminished.

In spring, for instance (fig. 1),* the Earth is moving in the same direction as the observer had seen the Sun in winter, viz., *w* S. To ascertain, therefore, in what direction O E (fig. 2) the point O is moving at or about the vernal equinox, he need simply ask the question, where was the Sun when its right ascension was six hours less, and with the declination belonging to it three months before the time of the observation? At the vernal equinox, and at sunset, the Sun is setting in the west, W (fig. 3), at a place O, of which H W R E is the horizon, and H Z P R s'' s' the meridian.

For the place of a Sun having 90°, or six hours less of right ascension, and the declination of the mid-winter Sun, we must take (fig. 3) P R s'' s' = the ⊙'s mid-winter N.P.D. = 90° + 23° 30′, and then O s' will be the direction of the Earth's motion, *i. e.* very nearly vertically downwards at sunset at the vernal equinox. In this case, and at this time, O E (fig. 2) lies at the back of H O R, and the number of visible meteors will thus be greatly diminished by the Earth's motion.

In London, about eight hours after the sunset at W, s' will reach the horizon at S′; *i. e.* about two o'clock in the morning the Earth will be moving in O S′ (fig. 3), in a horizontal direction; in other words, O E (fig. 2) will, about 2 A.M., be horizontal. About four hours after, *i. e.* at 6 A.M., S′ will be on the meridian at *m* (fig. 3), and the angle R O E (fig. 2) will be at its greatest magnitude, viz. the altitude, which the Sun attains to at mid-winter, *i. e.* about 15°.

Again, at the autumnal equinox, a very slight consideration of the figures 1, 2, 3, will show that the Earth is then moving in the direction in which the Sun had been seen at midsummer. At 6 P.M. the Sun is setting at W, and the observer O (fig. 3) is moving downwards in the direction O s'', where Ps'', ⊙'s midsummer N.P.D., = 90° − 23° 30′. About four hours later (see *Moore's Almanac*), *i. e.* at 10 P.M., the observer will be moving horizontally in O S″; and then the angle R O E (fig. 2) will continue to increase until about eight hours after 10 P.M. (*i. e.* at sunrise), when the motion of the observer will be in O m'' (fig. 3); the angle R O E (fig. 2) being equal to the altitude of the Sun at mid-summer, viz. about 62°. There will, therefore, in a northern latitude, in clear nights, be more shooting stars seen near the autumnal equinox than near the vernal, partly because O E is above the horizon during more hours of the night than at the vernal equinox, and partly because the direction of the Earth's orbital motion O E makes a considerably greater angle with the horizon H O R in autumn

* Fig. 1 is inadvertently lettered for the seasons in a southern latitude. It seemed scarcely worth while to correct it, especially as it may assist in showing how meteoric frequency follows the same *seasons*, both north and south of the equator.

than in spring. It follows also that at all seasons more meteors will be visible in an hour towards sunrise than in an hour towards sunset.

In a similar manner the same figures show distinctly what occurs at the summer and winter solstices; but a map of the stars, the *Nautical Almanac*, or even *Moore's Almanac*, together with the consideration of figs. 1, 2, 3, will be sufficient to enable an amateur to direct his observations of these strange meteoric bodies which swarm amidst the heavens. Such appears to be one general case of meteoric phenomena; but not unfrequently ephemeral swarms of meteors follow tracks emanating from a common centre, at capricious distances from the apex of the Earth's motion. For our knowledge of these we are at present mainly indebted to Mr. Grey's observations; but with regard to Mr. Herschel's ingenious extension of Mr. Bompas's principle enunciated in these remarks, the *experimentum crucis* will be, observations yet to be made in southern latitudes. And here it may be not alone pardonable, but even dutiful, to express our gratification that our knowledge of celestial phenomena is thus in progress of advancement through the successful labours of one bearing the name of Herschel. Rarely, indeed, is it accorded that intellectual acumen descends to the third generation.

It is to amateurs in astronomy especially that we must look for assistance in this interesting branch of celestial mechanics: these mineral fragments, these celestial rockets, this fiery dust from the lathe of the Omnipotent Worker, will furnish to him the correlative to that which the naturalist so fondly traces in the organic regions of creation — all space teeming with life — beauty, order, scattered on all sides with a lavish hand — yet everywhere, and all things, amenable to the control of law. — [C. P.]

Extract of a Letter from the Rev. W. R. Dawes to the Rev. C. Pritchard on the subject of the alleged recent Discoveries relative to the "Willow-leaved" Structure of the Sun's Photosphere.

"When Mr. Stone has presented his observations, as I suppose he will, to the Royal Astronomical Society, I may have more to say on this subject; but at present I will merely state that the observations of Messrs. Stone and Dunkin have *landed them precisely where I was sixteen years ago!* Soon after I had constructed a *transparent diagonal* on Sir John Herschel's principle (viz. *in the beginning of the year* 1848), and was delighting in being able by its means to see the whole disk of the Sun with a power of 65 on my Munich $6\frac{1}{3}$-inch with its whole aperture in use, I was struck with the

appearance of bright particles scattered almost all over the Sun, which I compared to *excessively minute fragments of porcelain*—not, however, all of the same shape or size. Now here are undoubtedly the '*rice-grains*' *of* 1864; but, being even then *observationally* rather an *old bird* (more than thirty years old as an observer), I was not to be caught with *rice-grains*, but set to work by every means to ascertain what they really were. I had seen too much of optical illusions to announce any appearance, however distinct, *as a new discovery*, before it had stood the test of the most careful scrutiny under the best circumstances, and with the highest magnifying powers. It was nearly *four years* before I was completely satisfied on the subject; it was not, in fact, till I had completed the construction of my new solar eye-piece, which enabled me to place any portion of the Sun's surface in a small field, and to examine the identical objects with every variety of power, and under circumstances fit for the use of 400 to 600 with advantage. I thus arrived at the decided conviction that these brilliant objects were merely *different conditions of the surface of the comparatively large luminous clouds themselves*—ridges, waves, hills, knolls, or whatever else they might be called—differing in *form*, in *brilliancy*, and probably in *elevation*, and bearing something of the same proportion to the individual luminous clouds that the masses of bright *faculæ*, as seen near the Sun's edge, bear to the whole disk of the Sun.

"As I arrived at this conclusion nearly twelve years ago, and as all my subsequent observations have only confirmed my conviction of its correctness, I fear that *further looking* is not likely to alter it; and I am presumptuous enough to think that my own view of the matter arises, not from my having looked so little, or requiring to 'look again,' but from the fact that I have probably looked *much more* than any of the observers who have lately come forward on the subject."

The foregoing communication from the Rev. W. R. Dawes, on the subject of willow-leaves, was read at the Meeting.

Mr. Pritchard remarked that the things asserted to have been seen by Mr. Nasmyth, the President, and the observers at Greenwich, were detached particles, nearly of a shape and nearly of a size, spread nearly all over the Sun, the interstices between these giving rise to its mottled appearance; Mr. Dawes details, in his letter, what he has seen during years of scrutiny, aided by his solar eye-piece. There is a question whether the effect upon the eye, of looking through a very minute aperture, gives the observer the real appearance, or whether diffraction comes into play, to an inconvenient extent. The other observers have seen the whole Sun's disk at

once. Mr. Dawes asserts that these little bright spots are not distinct entities, but are merely distinguishable brightnesses—parts of the same thing, which happen to be brighter than the other parts.

Mr. Huggins alluded to recent observations made when the atmosphere was peculiarly fine, so that he was able to use a much higher power (200) than usual. He has been long accustomed to see these bright particles which Mr. Stone has compared to rice, and which resemble rice very much when viewed with insufficient magnifying power on the telescope. But, on examining them with a higher power, they appear to him not to be uniform in size, and of almost every imaginable shape, though generally the two diameters are nearly equal. The point at issue is the relation which the bright particles bear to the mottling of the Sun's disk. Mr. Huggins perceived them most distinctly with the higher power on the darker portion of the Sun's mottling, and in every case separated, with a dark portion between them; they certainly do not overlap each other. Mr. Huggins has seen much larger masses of luminous matter, which, under an exceedingly good definition, are not broken up at all into minute particles; but, with a power of 50 or 100, these minute distinctions could scarcely be perceived; they are quite distinguished from the bright luminous streaks which Mr. Dawes has most happily compared to straws. They are also remarkable as ending abruptly or square; evidently not ending in a point where they project over the dark portions of the spot. It would certainly seem that the existence, over the whole surface of the Sun, of bodies having anything at all of the shape of willow-leaves, is incompatible with the appearance of the Sun on the occasions to which he referred. Mr. Huggins' observations were made with a diagonal glass reflector. In Mr. Dawes' eye-piece there is a narrow ring of diffracted light immediately within the margin of the opening; in the centre of the field, however, admirable definition is obtained.

The Rev. Mr. Howlett stated that, one day, during the autumn, he saw the well-known mottling on the Sun's surface; the comparative magnitudes of the bright particles varied from 5 to 9 seconds. He described them as crystalline flakes.

Capt. Noble, with a 4·2 aperture, had had two peculiarly fine views of the Sun during the month of March. On the first occasion, during an extraordinary fit of definition, he was tempted to think he had got hold, not exactly of the willow-leaves, but of the rice-grains; but, on looking again, and exchanging a power of 74 for one of 154, he then saw as nearly as possible what Mr. Huggins has described. What he took with a lower power to be an interlacing of these spots resolved itself into a series of dots, separated by darker intervals.

Mr. Brayley remarked that he had received a letter from Mr. Nasmyth, in which he gives four different forms of objects

as he observed them. First, he draws the willow-leaves, No. 1; No. 2 is shorter and a little wider; No. 3 is shorter still and a little wider still; and the fourth is exactly of the rice-grain pattern. He says of No. 1, you have the type of those forming the details of the penumbral strata. No. 2 (a little shorter) is that which forms the details of bridges. No. 3, which is shorter and wider still, is the form which constitutes the other parts of the bridges in the margin of the photosphere. Both 3 and 4 may be said to be a type of those that may be seen over the entire surface of the photosphere.

Mr. Stone stated that he had never seen any quite so long as Mr. Nasmyth's longest. He saw them with about 50, and tried 100 and 150. The higher the power used, the more distinctly were they seen.

Mr. Hodgson thought the discrepancies in the observations might be accounted for by supposing a want of care in obtaining the correct focus — an explanation which the President did not consider sufficient.

At the same Meeting, Mr. Howlett referred to a comparison which he had made between the Ely and Kew photographs of the Sun, taken between the 24th of January and the 1st of February, and exhibited the marked difference in the pictures produced at the same hour, and within a few minutes, at the two different stations. It would seem that the effects of difference of exposure will require to be very carefully considered before we come to any positive conclusion as to what was or was not the state of the Sun's disk at any given hour of the day. Without mentioning more minute differences, there is on the 28th of January a most striking difference between the pictures produced respectively at Kew and Ely, at 11.55 A.M. and 11.23 A.M. respectively. The Ely photographs generally show more of the faint details of the solar disk than those at Kew, but in this instance there is also most certainly a falling-off in that general accuracy and trustworthiness.

On the 28th of January, at 11.15 A.M., there was a very splendid group, which had been for some days previously, and remained subsequently, on the Sun's disk. There was specially to be noted a very large but feebly luminous bridge, spanning about three-fourths of the way across the great central *umbra*. That bridge is about one-fourth of the area of the umbra. There are no visible traces of this in the Ely photograph; while, at the same time, the subordinate spots of the group in the Ely photograph are beautifully and distinctly rendered.

It becomes those well versed in the subject to explain and give us their advice and counsel as to how these discrepancies are to be avoided, or to be interpreted, or perhaps even to be encouraged.

Professor Selwyn remarked: The small exposure of the Ely pictures, whilst it brings out in greater clearness most of the fainter features of the Sun, it fails in those parts where longer exposure seems necessary. He also mentioned that, at the next Meeting of the Society, the whole series of pictures taken during 1863 at Ely (then at the Royal Society) would be exhibited.

The President explained that he pointed out in the Bakerian Lecture for 1861 the cause of these discrepancies. The object of the pictures taken at Kew is not so much the definition of the physical features of the Sun as the obtaining the positions of them with a view to their reduction. There is thus a necessity for a little longer exposure, in order to get the limb of the Sun well brought out; and, in that way, many minor details, such as the details of the penumbra, are lost by over-exposure, which is not required for the Ely photographs. He attributes the delineation of some of the minute work in the Kew instrument to its being really in better chemical focus, evidenced by the details of the faculæ.

The President next adverted to the desirability of obtaining a photographic record, on a large scale, of the physical features of the solar surface, and stated that there was plenty of scope for any observer who should choose to take up the subject, and a very rich reward to be reaped. He had, as far as his leisure permitted, followed up the subject; and now that Professor Selwyn had taken a step in that direction, he would recommend his making the pictures on a larger scale than he at present contemplated — namely, six inches — which was not large enough to show the details of the spots. The image should be projected still further, and the single spots taken very much more enlarged.

Note respecting the List of Double Stars.

By the Rev. W. R. Dawes.

In the remarks appended to the List of New Double Stars, which I recently communicated to the Royal Astronomical Society, I have said, with respect to No. 7 of the List (*Procyon* and its very minute companion), — "I have heard that this minute object has been discovered independently at Mr. Barclay's Observatory; but I am not aware of the date."

I received my information respecting this discovery a year or two ago from Admiral Smyth, who had heard of it from

Mr. Hind; and the date was not mentioned. This evening, while looking over the *Monthly Notices* of last year, I found a communication from Mr. J. Gurney Barclay in the *Notices* for April 1863, respecting this very object; and appended to it are some measures by Mr. Hermann Romberg. I had totally forgotten having ever seen these. The date of the discovery given by Mr. Barclay is "1856, Jan. 10." He describes it as preceding *Procyon* in R.A. by from 3 to 4 seconds of time, "and but litle removed to the North in December." *So* it is printed; but the last word ought, I presume, to be "*declination*." Mr. Romberg's measurements give about Pos. = 295°, Dist. = 46″.

Hopefield Observatory, Haddenham,
Thame, April 4, 1864.

On the Companion of Sirius. By the Rev. W. R. Dawes.

On two recent occasions I have obtained distinct views of Alvan Clark's close companion of *Sirius* with my 8¼-inch object-glass.

On March 24th the air was rather thick, but the image of the star was unusually quiet and well defined; and though the companion was faint, yet there could be little doubt of its being really a star. To place this beyond suspicion, I turned the object-glass round into various positions, by unscrewing its cell, without any variation in the place of the small star, and also turned the eye-piece, and altered the situation of the object in the field, with the same result. Having applied the filar micrometer, and admitted a slight illumination of the field, I obtained a measure of position with the parallel thick wires = 84°·86; but the small star would not bear sufficient illumination to render the fine webs visible. To obtain a good estimation of the distance, I placed the *thick* moveable webs (which are parallel to the fine webs) at a distance of 15″, and bisected *Sirius* with one of them. The distance of the companion from the centre of *Sirius* was thus estimated to be two-thirds of the distance of the webs from each other, viz. about 10″.

On the 25th I obtained a much better view of this difficult object. The air was clearer, and *Sirius* as well defined as on the previous evening. The companion was so well seen that I had no doubt of getting good measures of distance. My solar eye-piece was on the telescope; and while exchanging this for the micrometer, and applying the illuminating lamp, clouds began to form in that neighbourhood, which soon obscured *Sirius*

itself. The view I obtained, however, fully confirmed the reality of the previous night's observation, and convinced me that good measures might be obtained in a suitable state of the air.

Hopefield Observatory, Haddenham, Bucks,
April 7, 1864.

On the Companion of Sirius. By W. Lassell, Esq.

The recently discovered companion of *Sirius* being an object of special interest just now, I send you a few measures of its position and distance, recently obtained by Mr. Marth and myself, respectively indicated by the letters M. and L.:—

1864·076	M. position	78°·53	mean of 6	measures,	greatest difference	0°·77
	M. distance	10″·50	„ 6	„	„	1″·15
1864·147	M. position	79°·58	„ 6	„	„	1°·82
	M. distance	10″·90	„ 6	„	„	0″·81
	L. distance	9″·53	„ 6	„	„	1″·88
1864·150	M. position	80°·29	„ 6	„	„	2°·10
1864·196	M. position	79°·23	„ 6	„	„	1°·42
	M. distance	10″·40	„ 6	„	„	0″·23
	L. distance	9″·71	„ 9	„	„	1″·35
1864·207	L. position	80°·15	„ 6	„	„	2°·12
	L. distance	9″·67	„ 6	„	„	1″·54

The large difference of measures of distance of M. and L. remains for future explanation. The powers used were 405 and 678, with which, in all tolerable conditions of the atmosphere, the small star could not be overlooked. The difficulty of distance-measures of stars so excessively unequal is, however, extreme, especially in the strong winds which so frequently prevail here in the winter. No other star was detected within the distance of that which has a position-angle of about 165° and a distance of about 2′. The small star appeared to me not a very small point, but to be deficient in brilliancy; it reminded me of the fifth star in the trapezium of *θ Orionis*, which has a dull reddish hue.

The late winter has been, I believe, unprecedentedly unfavourable in this island for astronomical observation; and many objects of interest, such as planetary and other nebulæ, have passed away without opportunity for careful scrutiny. Even for the nebula of *Orion* I must look forward to another

winter to enable me to complete its examination. I have, however, verified several of the very minute stars in the neighbourhood of the trapezium which I discovered in my former expedition (see *Memoirs, Roy. Ast. Soc.*, vol. xxiii. plate iii.) during the remarkably fine winter of 1852–3; and I have detected a few others, though I have not had opportunity in good circumstances to make any very diligent search.

When not engaged with other objects, Mr. Marth has generally used up whatever clear sky we have had, in the absence of the Moon, in searching for new nebulæ, of which there are already near 200 on our list.

Malta, March 26, 1864.

Letter from Herr Theodor Oppelzer to the Astronomer Royal, received April 11, 1864.

(*Translated by W. T. Lynn, Esq. B.A., Univ. London, of the Royal Observatory, Greenwich.*)

"I have the honour of sending you the elements of the Planet (76) *Freia* = (80) *Sappho*. They are, indeed, not yet perfectly accurate, as it was necessary first to wait for Pogson's observations. Nevertheless they already agree tolerably nearly with the observations. In deducing them I have made use of the observations: Copenhagen, 1862, Oct. 24, Nov. 1, Nov. 20, and Berlin, Nov. 27; also Pogson's approximate position, which I assumed to apply to Feb. 10, and my own observation as follows: —

Mean Time Josephstadt.	App. α.	Log (P × Δ).	App. δ.	Log (P × Δ).
1864. h m s	h m s		° ′ ″	
April 2 9 48 12	8 26 38·61	+9·323	+16 48 23·9	(0·674)

"The Elements are —

Epoch = 24·5 Oct. 1862, Mean Berlin Time.

M	= 312 16 20·3	
ϖ	= 92 52 4·3	Mean Equinox 1864.
Ω	= 213 3 21·2	
i	= 2 1 51·5	
φ	= 10 47 17·2	
μ	= 569″·3699	
log a	= 0·529742	

and the places are thus represented, according to a hasty calculation, in the direction Calculation — Observation:—

	$\delta\lambda$.	$\delta\beta$.
	′	′
1862, Oct. 24	0·1	0·0
Nov. 1	+0·1	0·0
20	+0·2	−0·1
27	0·0	+0·1
1864, Feb. 10	+0·3	−0·5
April 2	0·0	0·0

"In my opinion the identity of d'Arrest's and Pogson's Planets can no longer be doubted. The following is a small Ephemeris, which will, perhaps, be of use. (The planet is of the 12th magnitude):—

0^h Berlin Time.

	α	δ	log. Δ
	h m s	° ′	
April 8	8 29 13	+16 44·4	0·389
9	29 45	43·5	
10	30 18	42·5	
11	30 52	41·4	
12	31 28	40·3	0·399
13	32 5	39·0	
14	32 42	37·6	
15	33 21	36·0	
16	34 0	34·4	0·409
17	34 40*	32·7	
18	35 22	31·0	
19	36 4	29·3	
20	36 47	27·5	0·419
21	37 31	25·6	
22	38 17	23·6	
23	39 4	21·5	
24	8 39 52	+16 19·3	0·429

"It would be a thing that I should desire, if you would have the kindness to communicate something of this to the *Monthly Notices*."

* In the original, $34^m\,4^s$.—W. T. L.

Instrument for Sale.

ALTITUDE and AZIMUTH INSTRUMENT, by Thomas Jones, of 62 Charing Cross: cost about 120*l.* Circles about $13\frac{1}{2}$ in. diameter, divided on silver to 10 min. Object-glass of telescope, $1\frac{7}{8}$ in. Length of focus, about 19 ins. Between centres of standards. $7\frac{1}{2}$ ins.; between centres of Ys, $13\frac{1}{2}$ ins. There is a spirit-level attached to the upper horizontal plate, to which the standards are fixed. The instrument may be seen at Pastorelli's, 208 Piccadilly.

CONTENTS.

	Page
Fellows elected	133
Notice of a corrected List of the Fellows	ib.
State of Meteoric Science, by Mr. A. S. Herschel	ib.
On the preceding communication, by the Rev. C. Pritchard	135
Extract of a Letter from the Rev. W. Dawes to the Rev. C. Pritchard on the subject of the alleged recent Discoveries relative to the "Willow-leaved" Structure of the Sun's Photosphere	139
Discussion on the same subject	140
On the Ely and Kew Photographs of the Sun: Mr. Howlett, Professor Selwyn, and the President	142
Note respecting the List of Double Stars, by the Rev. W. R. Dawes ...	143
On the Companion of *Sirius*, by the Rev. W. R. Dawes	144
On the Companion of *Sirius*, by Mr. Lassell	145
Letter from Theodor Oppelzer to the Astronomer Royal, containing Elements and Ephemeris of Planet (76) *Freia* = (80) *Sappho* ...	146
Instrument for sale	148

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